DOCKET NO.: KCX-487B (17429B)

UNITED STATES PATENT APPLICATION

FOR

ROLLED WEB PRODUCTS HAVING A WEB WOUND IN AN OSCILLATING FASHION

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DOCKET NO.: KCX-487B (17429B)

Cross Reference to Related Applications

This patent application relates to another application entitled METHOD AND APPARATUS FOR WINDING A WEB by Lake et al. which was filed December 22, 2001.

Background of the Invention

Various manufacturing operations engage in winding web material around a central core. Such winding is employed to manufacture a host of products that are made for use in modern society, including tape, plastics, cording, nonwoven materials and the like.

Natural and synthetic textiles, nonwoven materials, and conform materials may be manufactured in a first process to produce bulk materials, and then stored for later use in a second process. For example, such material may be wound upon spools or cores for temporary storage in relatively large quantities until the bulk material is needed to manufacture products. For example, many consumer and disposable absorbent products are manufactured in a first process, and then spooled on large spools while they await a subsequent manufacturing process. In manufacturing, the spools may be removed from storage and then transported to a location where they are needed,

and then placed into a manufacturing line for use. Such web materials may be fed from the spool into the manufacturing operation.

One problem encountered when unwinding elongated web material from spools or rolls is undesirable twisting of the web as it uncoils when the roll is kept in a stationary position. Various methods have been attempted to avoid twisting, which can lead to problems in manufacturing. Twisting may occur when a core or spool is placed upright on a level surface, with the core oriented vertically, and such materials are pulled or fed from the core in a direction that is not in alignment with the core or spool. Some manufacturing operations in the past have relied upon driven unwind systems to assist in such operations. However, such systems consume energy and require maintenance.

Some processes have employed continuous strips of material in a technique known as "festooning" in which the strip is folded back and forth to lay a series of strip portions, with each portion being folded relative to the next about a line transverse to the strip. The technique of festooning has been used for some time and is employed in the manufacture of packaging materials including nonwovens, fabrics, and the like. The strip may be guided into a cardboard box, or may be rolled into a cylindrical pad, as examples. International Patent Application Publications WO 99/59907 and WO 99/16693 illustrate such methods.

What is needed in the industry is a new roll that is manufactured in a manner that minimizes the opportunity for undesirable twisting during deployment of a web from the roll. A method of winding such materials in a manner that will provide reliable unspooling of web materials is desirable. Furthermore, a method or assembly that provides an opportunity to make and deploy multiple spools or rolls in succession without stopping to reload rolls would be helpful. Furthermore, a system that enables utilization of rolls without using a conventional driven unwind system would be quite useful.

Summary of the Invention

The invention may include a rolled web having an outer surface. The web may or may not have a core, depending upon the configuration employed. The web may be wrapped around a core, the web having a first end and a second end, the first end of the web being positioned adjacent the outer surface of the core, and the second end of the web being positioned on the outer circumferential surface of the roll. The web is positioned upon the outer surface of the core in a manner whereby the web is positioned in a first direction, and also in a second and opposite direction, in alternating sequence, from the first end of the web to the second end of the web.

The web may be manufactured using a method of winding a material around a central core or airshaft, using an apparatus that is capable of oscillation. An apparatus is provided for winding a web

around a central axis to form a roll. The apparatus may include a rotating mandrel oriented along the central axis, and a feeding mechanism including at least one roller for holding in a feed position a running web to be wound upon the rotating mandrel.

The invention may provide a method for winding a web to form a roll. The method may include steps such as providing a mandrel along an axis, and then feeding a web through a feed assembly for winding the web upon a rotating mandrel. Furthermore, a retainer assembly may be provided in operable connection to the rotating mandrel. The retainer assembly (or retainer means) may serve to preserve the web in position during rotation of the mandrel and roll.

Brief Description of the Drawings

A full and enabling disclosure of this invention, including the best mode shown to one of ordinary skill in the art, is set forth in this specification. The following Figures illustrate the invention:

Figure **1** is a front view of the winding apparatus in the counter clockwise mode or position;

Figure **2** shows a rear view of the winding apparatus, also in the counter clockwise position;

Figure **3** depicts a second front view of the winding apparatus in the counter clockwise position, in which the mandrel has advanced or rotated towards the left in the Figure;

Figure **4** is a view of the assembly in the clockwise position or mode; and

Figure **5** shows a rolled web product manufactured using the winding apparatus shown in Figures **1-4**;

Figure **6** shows a second embodiment of a rolled web product;

Figure **7** is a schematic cross sectional view of a coreless rolled web product, showing how web is overlapped and is wound in both a first and second direction, in alternating sequence;

Figure **8** is another schematic showing how the overlap point may move about the periphery of the web as the web is wound;

Figure **9** shows a later point in the winding, when the web winding direction has been reversed; and

Figure **10** shows a cross-section of a multiple "stacked" roll assembly that can be manufactured in the practice of the invention.

Detailed Description of the Invention

Reference now will be made to the embodiments of the invention, one or more examples of which are set forth below. Each example is provided by way of explanation of the invention, not as a limitation of the invention. In fact, it will be apparent to those skilled in the art that various modifications and variations can be made in this invention without departing from the scope or spirit of the invention. For instance, features illustrated or described as part of one embodiment can be used on another embodiment to yield a still further embodiment.

The term “web material” or “web” as used herein refers to a sheet-like material or to a composite or laminate comprising two or more sheet-like materials. For example, such materials may include a fibrous web, a non-fibrous web, a nonwoven web, a film, a plastic film, a non-plastic film, a foam, tape, cording, textiles, rope, and tubing. Such webs or web materials may be supplied to the manufacturing process along the longitudinal dimension. Accordingly, the material may be rendered virtually infinite in the longitudinal dimension by splicing together a plurality of stretches of web material, or a plurality of rolls.

The apparatus and method of the invention may include the winding of a web or other material around a central core wherein the material is wound in an oscillating fashion. However, a core is not always required, as further discussed herein.

The web or web material may be wound in any amount, such as from about 1 to about 3 revolutions in one direction, and then the winding direction is reversed for several more revolutions, and repeated to wind a running web into a roll. In practice, the overlapped tail of the web in each revolution may be secured to the overlapped tail of the web in a previous revolution to hold the web and prevent it from unraveling during the winding process. The winding process may be repeated until the desired roll diameter is obtained. The application of the method and apparatus of the invention makes it possible to minimize the amount of twist generated in the final product or roll when the roll is unwound from a

stationary position in manufacturing operations, as further described herein with reference to Figure **5-10.**

The winding of the web may occur upon a core, or alternatively upon a collapsible airshaft. The amount of overlap employed between directional changes may be subject to web material response and footprint, and the distance required to enter the material in the converting process without an undesirable twist.

In one particular embodiment of the invention, the web is wound approximately 370-720 degrees in a clockwise direction, and then wound again 370-720 degrees in a counter clockwise direction, and repeated. The amount of overlap may be varied, and will depend upon the material to be wound, and the ultimate use for the roll. Furthermore, the overlap as described may be moved about the radius of the roll, during winding, by changing the location of the overlap as the roll is built. In practice, changing the location of the overlap sometimes prevents a double material thickness at the overlap, thereby avoiding a roll that is undesirably out of round.

Turning now to Figure **1**, a winding apparatus **20** is shown which feeds a running web **21** upon a mandrel **22** that is located along a central axis. A cleavage roll assembly **23** directs the application of the web **21** upon the roll **27**. The web **21** is passed to the first cleavage roll **24** and a second cleavage roll **25**. A support structure **26** is capable of controlling the position of first cleavage roll **24** and second cleavage roll **25**. The

cleavage roll assembly **23** therefore may include a first cleavage roll **24**, a second cleavage roll **25**, and a support structure **26**.

A stationary retainer assembly **35** is mounted around the central axis of the mandrel **22**, and is configured for accommodating oscillating movement of the roll **27** between a clockwise and counter clockwise direction. In Figure **1**, the web **21** is passed underneath the first idler roll **29** to the roll **27**. A counter clockwise direction assist paddle **32** is shown in Figure **1** in the active position in which the counter clockwise directional assist paddle **32** is extended to enable it to contact and retain the web **21** upon the outer surface of the roll **27**. It should be recognized that the directional assist paddles **31-32** may be provided in any mechanical configuration, and therefore they may be flat, oblong, spherical, or multi-lobed. In some applications, only one such paddle may be required. The Figures represent one configuration having relatively flat directional assist paddles **31-32**, but there are numerous shapes that could be employed in the practice of the invention.

A second idler roll **30** is also seen in Figure **1**. The second idler roll **30** controls the position of the second circumferential support stay **34**. The first idler roll **29** controls the position of the first circumferential support stay **33**. The first circumferential support stay **33** and the second circumferential support stay **34** work in tandem on each side of the roll **27** to retain the web **21** upon the roll as the roll **27** is building in size. The

clockwise direction assist paddle **31** is shown in Figure **1** in the retracted position.

The cleavage roll assembly **23** is typically capable of switching between two or more different modes. In the dual mode, a first position of the cleavage roll assembly **23** as shown in Figure **1** may provide an air cylinder **44** which has been activated along rod **45** to push the bar **46** into notch **47** of the support structure **26**. This activation enables the web **21** to pass in the appropriate direction between the first cleavage roll **24** and the second cleavage roll **25**, as shown in Figure **1**. Support frame **38** holds the support structure **26** in position.

The clockwise direction assist paddle **31** is activated along rod **43** by air cylinder **41**. The counter clockwise direction assist paddle **32** is activated along rod **42** by air cylinder **40**.

In the process of winding a roll **27**, the rotation of the mandrel **22** in a counter clockwise direction is halted. The clockwise directional assist paddle **31** extends to contact web **21** and introduces the web **21** into a nip area which is created by second idler roll **30** and roll **27**. The mandrel **22** then begins to rotate clockwise, which may continue until the web **21** begins feeding between the roll **27** and second circumferential support stay **34**, upon which the clockwise directional assist paddle is retracted.

The retainer assembly **35** receives support from control arms **37a-d**, as shown in Figure **2**. Figure **2** shows a rear view of the winding

apparatus **20**. In Figure **2**, the mandrel has been rotated so that the web **21** is proceeding into the roll **27** from a direction that is gen rally parallel to the support frame **38**. The support frame **38** holds in position the cleavage roll assembly **23** and the directional assist paddles **31-32**.

In Figure **2**, a control arm guide member **50** including channels **49a-b** is shown. Bolt **51** and bolt **52** are connected, respectively, to control arms **37b-c** and control arms **37a** and **37d** as shown in Figure **2**. The movement of bolt **51** upwards and bolt **52** downwards allows the size of the roll **27** to expand. In that way, the control arms **37a-d** articulate with each other to facilitate a change in size of the roll **27** as the winding process proceeds.

Figure **3** shows a front view of the winding apparatus **20** that was seen in Figure **2**. In Figure **3**, the counter clockwise directional assist paddle **32** has been activated by the air cylinder **40** along rod **42** to an active position. Also, in Figure **3**, the clockwise direction assist paddle **31** has been retracted by movement of air cylinder **41** along rod **43** away from the roll **27**. A roller **54** is shown in position to retain the first circumferential support stay **33** upon the upper surface of the roll **27**. A roller **55** is shown in position to retain the second circumferential support stay **34** upon the lower path of the roll **27**, as shown in Figure **3**.

As the winding assembly **20** shifts from a counter clockwise mode into a clockwise mode, several adjustments are made. As shown in Figure **4**, the winding apparatus **20** now has assumed a clockwise mode

in which the counter clockwise directional assist paddle **32** has been retracted, and the clockwise directional assist paddle **31** has been extended. Furthermore, as seen in Figure **4**, web **21** now feeds from a different direction, through the first cleavage roll **24** and the second cleavage roll **25**. Adjustment of the first cleavage roll **24** and second cleavage roll **25** has occurred by the actuation of air cylinder **44**, which extends rod **45** to move bar **46** into notch **47**, resulting in movement of the first cleavage roll **24** and second cleavage roll **25** to the position shown in Figure **4**. In that position, the web **21** now is prepared to wind upon the rotating mandrel **22** in the clockwise direction, with the clockwise direction assist paddle **31** extended to contact the surface of the roll **27**. This contact holds the web **21** in position during a change in oscillation of the winding apparatus **20**.

The invention is not limited to the use of such paddles to retain the roll **27** at each end of the oscillation. For example, other methods could be used to secure overlapping layers of the web **21** during winding of the roll **27**. These methods include, but are not limited to, the use of adhesives, thermal bonding, ultrasonic techniques, or mechanical bonding methods. For example, an adhesive could be sprayed upon the web **21** at each end of the oscillation cycle, at about the point at which the web **21** reverses direction.

In the practice of the invention, the opportunity exists to lay several oscillated rolls (such as roll **27**) on top of each other, in

succession. That is, it is possible to attach the inner tail of an expiring roll to the outer tail of a new roll to provide a stack of rolls which are interconnected. Such an arrangement would permit the rolls, when they are later used, to unwind in succession. That is, multiple rolls could be wound, and connected by web **21**, thereby avoiding or minimizing the need for a dynamic splice. In general, a dynamic splice refers to a splice that must be made when a roll must be replaced in the course of a manufacturing operation. Thus, a stack of rolls, or a pancake wound oscillated roll stack could be constructed, which may obviate the need to use a dynamic splice.

Figure **5** shows a sheet-like rolled web product **100** produced using the apparatus of the invention. A core **101** is used in this particular example, and a first end **102** of the web is adjacent the core **101**, while a second end **103** is shown on the outer circumferential surface of the web **104**.

Figure **6** shows a rope or cordage type of rolled web product **110** produced using the apparatus of the invention. A core **111** is provided in this particular example, and a first end **112** of the web is adjacent the core **111**, while a second end **113** is shown on the outer circumferential surface of the web **114**.

In Figure **7**, one can see the method of forming overlap using the apparatus of the invention. This particular example shows a coreless rolled web product **120**. The web is positioned upon the outer surface of

the center air space **130** in a manner whereby the web **121** is positioned in a first direction, and also in a second and opposite direction, in alternating sequence, from the first end of the web to the second end of the web.

The web **121** is wrapped upon the core in a pattern resulting from oscillating revolutions about the core, in which a first tail **124** (or first overlap) is formed upon the web **121** at a point corresponding to the directional change. A second overlap or second tail **125** is formed in the next revolution, and third overlap or third tail **127** in the next, and fourth overlap or fourth tail **129** in the next (see Figures **7-9** as well). Each successive tail is secured in an overlapping manner to the tail of the web **121** from a previous revolution.

In Figure **7**, a first paddle **123** is extended to contact web **121** to hold it while a directional change to counter clockwise direction **122** is made. Figure **8** shows the rolled web product **120** reversing to proceed again in the clockwise direction **128**, with second paddle **126** extended to hold third tail **127** in position to prevent undesirable unraveling as the roll builds.

Figure **9** shows first paddle **123** once more extended to hold fourth tail **129**, as the overlapping and winding process continues.

An example of a stacked roll assembly **160** that can be produced according to the method of the invention as previously described is shown in Figure **10**. In Figure **10**, a stacked roll assembly **160** is shown

having a first pancake roll **163** and a second pancake roll **164** stacked vertically. In general, there is no limit to the number of such pancake rolls **163-64** that can be stacked in forming a stacked roll assembly **160**. Figure **5** shows one example in which two stacked pancake rolls **163-64** are provided, but a stacked roll assembly **160** could have as many as four, five, six or more pancake rolls stacked together. The stacked roll assembly **160** could include optional cores **161-62**, or in other applications it may be possible to construct pancake roll **163** and pancake **164** without cores **61-62**, using a removable mandrel (not shown) or an air cylinder (not shown).

The stacked roll assembly **160** is shown in Figure **10** in position to be unwound and deployed in the manufacture of products. In Figure **10**, the web **21** is pulled upwards and released from the first pancake roll **163**. Once the first pancake roll **163** is exhausted, the process continues with the tail end **165** of the web **21** being connected to the lead end **166** of second pancake roll **164**. Deployment of the stacked roll assembly **160** therefore may, in some manufacturing applications, without the necessity of stopping a manufacturing operation to insert a new roll:

In some applications, it is possible to provide a shaft upon which the web **21** is wound (shaft not shown). The web **21** also could be driven through a series of friction drive rollers (not shown in Figure **10**). The web **21** could be attached to such a shaft and wound in a clockwise direction between about 1 and about 3 revolutions, then the process

could be halted and a nominal amount of adhesive could be applied to the outside of the web **21**. Then, the process could continue in a counter clockwise direction until a nominal amount of web **21** passes through the adhesive application point (not shown in Figure **10**). Then, the direction can be reversed again with the web **21** moving again in the clockwise direction. In this way, the infeed material web **21** could be allowed to move upward, thereby changing the angle of web **21** orientation in reference to the building roll.

It is understood by one of ordinary skill in the art that the present discussion is a description of exemplary embodiments only, and is not intended as limiting the broader aspects of the present invention, which broader aspects are embodied in the exemplary constructions. The invention is shown by example in the appended claims.